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Air Force SBIR/STTR
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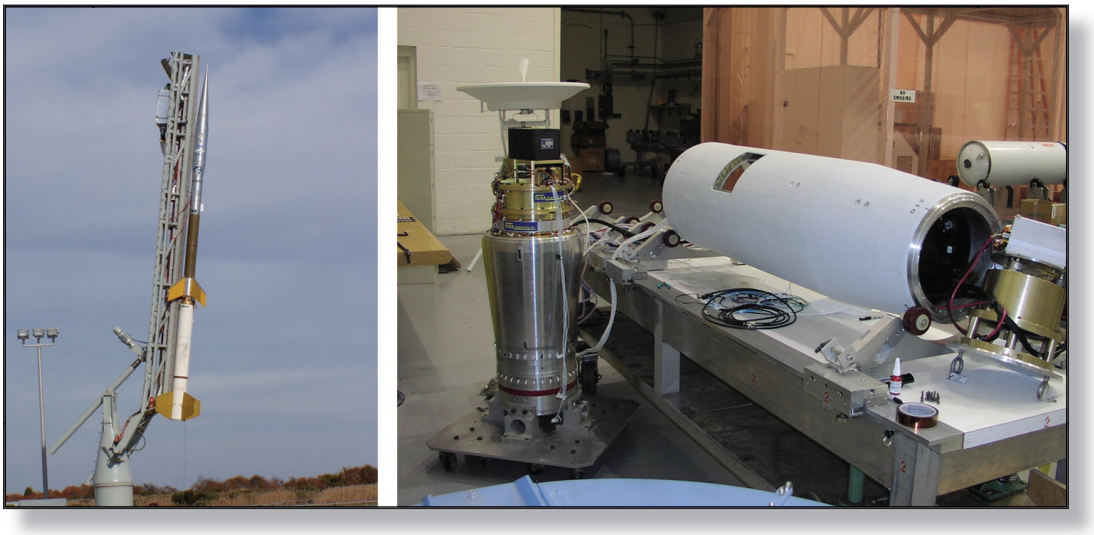
Success Story

VIBRO-ACOUSTIC LAUNCH PROTECTION EXPERIMENT



Several new launch environment mitigation technologies were put to the test as part of the Vibro-Acoustic Launch Protection Experiment (VALPE) aboard a Terrier-Orion sounding rocket launched from Wallops Island Flight Facility, Virginia. Several groundbreaking technologies claimed first-flight heritage: hybrid active-passive vibration isolation, regenerative vibration isolation, an adaptive acoustic absorber, and a new lightweight composite fairing structure.

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Accomplishment

The Space Vehicles Directorate and CSA Engineering, Inc. developed a hybrid active-passive vibration isolation system under a Small Business Innovation Research (SBIR) Phase II enhancement. The system takes the next step beyond state-of-the-art passive isolation systems, enabling increased performance through the use of voice-coil actuation.

Through a Cooperative Research and Development Agreement, the directorate and Boeing-SVS, Inc. built a regenerative isolation system. This system uses a non-linear passive stage to provide soft-spring isolation while the vehicle is under acceleration. The active stage actually captures vibration energy and converts it to electricity for storage during launch and then uses the stored energy to provide actuation during stage separation.

The directorate and Boeing-SVS, Inc. also built an Adaptive Vibro-Acoustic Device to absorb acoustic energy from the interior. The ChamberCore payload shroud, built by Delta Velocity as part of a Phase II SBIR, is a series of rectangular composite tubes held together by face sheets. Such structures are stiff but lightweight and have the potential to reduce the interior sound by either filling the chambers with mass to serve as an acoustic barrier during the noisy liftoff or by strategically drilling holes and placing damping material to turn the chambers into tuned Helmholz resonators.

The directorate holds patents on each of these technologies. The rapid transition from basic research in the laboratory to flight experiment should ensure that operational systems are available to mission planners in the near future.

Background

VALPE is a series of two flight experiments to demonstrate the potential of several new technologies to mitigate the vibro-acoustic environment of a launch vehicle during ascent and to protect sensitive payloads. Reduction of the launch loads enables lighter weight payload structural designs, increased risk margin, or reduced ground testing levels.

The first sounding rocket flight, VALPE-1, was launched from Wallops Island Flight Facility and was heavily instrumented in order to fully characterize the violent vibro-acoustic environment. VALPE-2, launched on an identical sounding rocket along the same flight path, contained four experiments designed to mitigate the environment, reducing both vibration and acoustic loads. Results from VALPE-2 may be scaled for application to operational missions.

Space Vehicles
Technology Transfer

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VS-23)